Center Independent Research & Development: GSFC IRAD

Phase Occulted Nulling Coronagraph: Instrument Technology Advancement (PONC)

Completed Technology Project (2015 - 2017)

Project Introduction

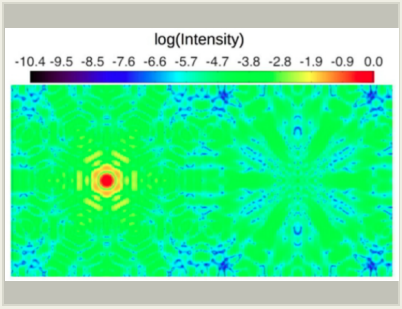
The Phase Occulted Nulling Coronagraph (PONC), invented by R. Lyon, is a viable and game-changing approach for future arbitrary shaped aperture exoplanet science missions. It enables direct exoplanet imaging with a filled, obscured or segmented telescope due to its field-dependent pupil plane rejection of starlight (nulling) . In FY16 we plan to fabricate and test a set of prototype PONC optics as a proof of the principle.

The projects full objective is to demonstrate that a given PONC optical design can be fabricated using current state of the art techniques. This serves to demonstrate one of the key remaining issues with the PONC approach, i.e. *that the aspheric surfaces of the 4 PONC optics can be fabricated, aligned, tested and achieve, and hold, high contrast imaging*. This advances the PONC optics from a simulation (TRL-2) to a lab prototype (TRL-3). Ultimately the PONC optics will be tested in GSFC's laboratory visible nulling coronagraph (VNC).

GSFC is the lead center for the PONC, it was invented here, and GSFC has a vested interest in it as a potential game-changing exoplanet technology. The science payoff is its ability to (i) image/characterize exoplanets with a segmented aperture telescope, (ii) over a wide field of view, and (iii) with less demanding telescope stability tolerances. The successful fabrication and demonstration of the PONC optics results in ***improved cost efficiency*** since our approach relaxes the stability tolerances of segmented telescopes, eases requirements on on-orbit operations and ground testing, resulting in a lower cost mission with the same science yield.

Anticipated Benefits

The primary benefit will be to enable exoplanet science for a segmented aperture telescope for the future (in planning) ATLAST/LUVOIR mission.



The figure shows the simulated output after nulling, the goal of this effort is for the diffracted coherent residual intensity to be 1e-8 or less at three diffraction radii.

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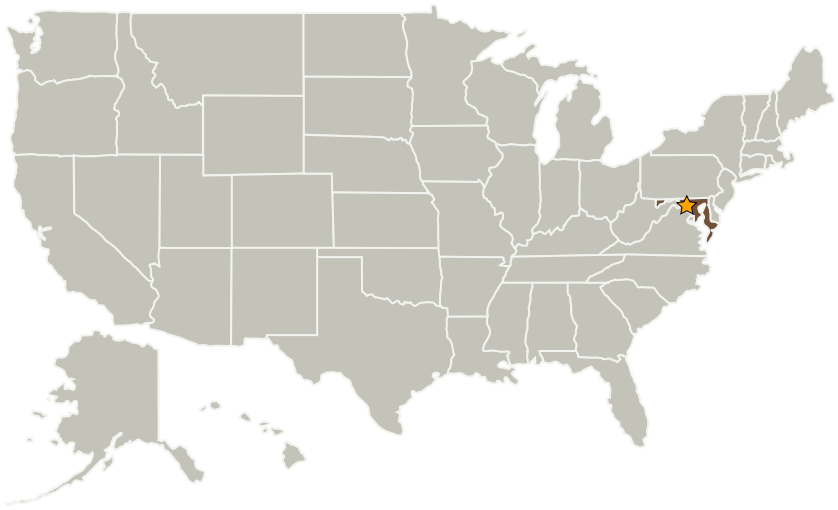
Primary U.S. Work Locations and Key Partners



Organizations Performing Work	Role	Type	Location
★Goddard Space Flight Center(GSFC)	Lead Organization	NASA Center	Greenbelt, Maryland

Primary U.S. Work Locations
Maryland

Project Transitions

October 2015: Project Start

Organizational Responsibility

Responsible Mission Directorate:

Mission Support Directorate (MSD)

Lead Center / Facility:

Goddard Space Flight Center (GSFC)

Responsible Program:

Center Independent Research & Development: GSFC IRAD

Project Management

Program Manager:

Peter M Hughes

Project Managers:

Terence A Doiron
Megan E Eckart
Timothy D Beach

Principal Investigator:

Joseph M Howard

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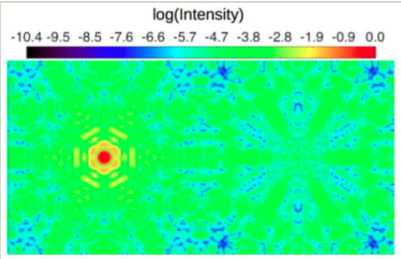
September 2017: Closed out

Closeout Summary: The purpose of the Goddard Space Flight Center's Internal Research and Development (IRAD) program is to support new technology development and to address scientific challenges. Each year, Principal Investigators (PIs) submit IRAD proposals and compete for funding for their development projects. Goddard's IRAD program supports eight Lines of Business: Astrophysics; Communications and Navigation; Cross-Cutting Technology and Capabilities; Earth Science; Heliophysics; Planetary Science; Science Small Satellites Technology; and Suborbital Platforms and Range Services.Task progress is evaluated twice a year at the Mid-term IRAD review and the end of the year. When the funding period has ended, the PIs compete again for IRAD funding or seek new sources of development and research funding or agree to external partnerships and collaborations. In some cases, when the development work has reached the appropriate Technology Readiness Level (TRL) level, the product is integrated into an actual NASA mission or used to support other government agencies. The technology may also be licensed out to the industry.The completion of a project does not necessarily indicate that the development work has stopped. The work could potentially continue in the future as a follow-on IRAD; or used in collaboration or partnership with Academia, Industry and other Government Agencies.If you are interested in partnering with NASA, see the TechPort Partnerships documentation available on the TechPort Help tab. http://techport.nasa.gov/help

Images



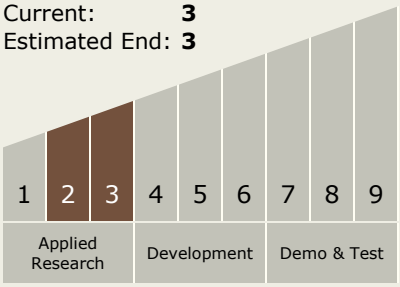
PONC Intensity Simulation
The figure shows the simulated output after nulling, the goal of this effort is for the diffracted coherent residual intensity to be 1e-8 or less at three diffraction radii. *(https://techport.nasa.gov/image/26365)*

Project Website:

http://sciences.gsfc.nasa.gov/sed/

Technology Maturity (TRL)

Start: **2**
Current: **3**
Estimated End: **3**



Technology Areas

Primary:

- TX08 Sensors and Instruments
  - TX08.1 Remote Sensing Instruments/Sensors
    - TX08.1.3 Optical Components

Target Destination

Outside the Solar System